method of the present invention is read out by the system or the apparatus, and this method is actually implemented in the system or the apparatus.--

Please substitute the following paragraph for the paragraph starting at page 57, line 20 and ending at line 23. A marked-up copy of this paragraph, showing the changes made thereto is attached.

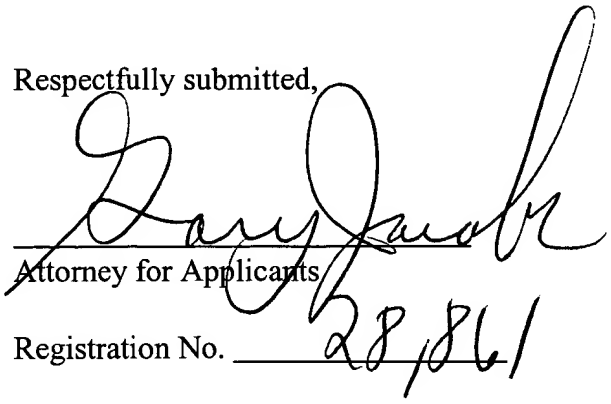
--According to the present invention, image quality, water-resistance immediately after the printing, wear resistance, and overwriting resistance are improved.--

REMARKS

This Amendment is a supplement to the February 22, 2001 Amendment. In this Supplemental Amendment, the specification has been amended to improve its form. Applicants submit that the application is in condition for allowance for the reasons given in the February 22, 2001 Amendment.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

Please substitute the following paragraph for the paragraph starting at page 1, line 12 and ending at line 17.

--Japanese Laid-open Patent Application No. SHO- 58-128862 discloses that oily processing liquid is applied to [the] an image region formed by the dye ink before or after the ink application, by which the coloring material is fixed on the recording material to improve the water-resistance.--

Please substitute the following paragraph for the paragraph starting at page 1, line 18 and ending at line 26.

--Japanese Patent Application No. HEI- 8-204618 and Japanese Laid-open Patent Application No. HEI- 10-44394 assigned to the assignee of this application disclose that cationic processing liquid is applied on [the] a [topping type] topping-type or non-penetrative type ink (the ink having less penetration property) deposited on the surface of the recording material to cause an instantaneous reaction to produce [a] reaction products thereof on the surface of the ink.--

Please substitute the following paragraph for the paragraph starting at page 2, line 9 and ending at line 18.

--As a result, the insolubilized coloring material tends to remain on the surface of the recording paper, and therefore, the wear resistance, and the resistance against the overwriting

when a line marker or a writing device is used to write on the recorded image(overwriting resistance) are not good. In other words, when the recording paper having the recorded image is rubbed, the coloring material on the surface is removed resulting in the deterioration of the image quality, or spread occurs upon overwriting.--

Please substitute the following paragraph for the paragraph starting at page 2, line 20 and ending at page 3, line 1.

--SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to provide a recording method and apparatus wherein the water-resistance of Bk ink is improved, the spread between the Bk ink and the color ink is reduced, and the image quality of the Bk ink is improved; and in addition, the water-resistance, the wear resistance, and the overwriting resistance immediately after the printing, are improved.--

Please substitute the following paragraph for the paragraph starting at page 3, line 2 and ending at line 10.

--In the present invention, [the] a processing liquid capable of reacting with and fixing a coloring material of ink is supplied to the ink, which has [been] penetrated [to] the fibers of the recording material and which has started to swell ("swelled ink" which is the ink after the swell start time Ts has elapsed or the ink changed by a heater or the like). The property of the processing liquid or the heating after the processing liquid application or the like, is usable.--

Please substitute the following paragraph for the paragraph starting at page 3, line 12 and ending at line 14.

--(1) it is preferable to apply an ultra-penetrative($Ka \geq 5$) processing liquid to an ink having $Ka \leq 3$ m $m^{-2}.msec^{-1/2}$[.];--

Please substitute the following paragraph for the paragraph starting at page 3, line 15 and ending at line 20.

--(2) it is preferable that when ink has $Ka \leq 1$ and has a penetration property [which] that exhibits temperature dependence, heat is applied by a heater after ink application to the recording material, and then a penetrative processing liquid, which is semi-penetrative or more penetrative, is applied[.]; and--

Please substitute the following paragraph for the paragraph starting at page 3, line 21 and ending at page 4, line 2.

--(3) it is preferable that when the ink is semi-penetrative or more penetrative ($Ka > 1$), [the] heat is applied by a heater after ink application to the recording material, and thereafter, semi-penetrative or more penetrative processing liquid is applied. Further preferably, as a second step, heat is applied by a heater after the first step. The processing liquid in this case may by a semi-penetration property.--

Please substitute the following paragraph for the paragraph starting at page 4, line 3 and ending at line 5.

--This is effective to promote the penetration of the processing liquid by the heater and to improve the fixing property by [the] evaporation promotion.--

Please substitute the following paragraph for the paragraph starting at page 4, line 6 and ending at line 10.

--[It may be an] An ultra-penetrative processing liquid may be used, and in such a case, the fixing property is further improved by [the] evaporation promotion, and [the] coating reinforcement is accomplished. By the second step, further advantages are provided.--

Please substitute the following paragraph for the paragraph starting at page 4, line 14 and ending at line 16.

--a step of ejecting onto a recording material ink having a Ka value of not more than 3 ($ml.m^{-2}.msec^{-1/2}$); and--

Please substitute the following paragraph for the paragraph starting at page 4, line 17 and ending at line 21.

--a step of applying to the ink deposited on the recording material, a processing liquid having a Ka value of not less than 5 ($ml.m^{-2}.msec^{-1/2}$) to [insolubilized] insolubilize a coloring material in the ink inside the recording material;--

Please substitute the following paragraph for the paragraph starting at page 4, line 22 and ending at line 25.

--wherein the processing liquid is applied to the ink after the rapid swell start point ts after penetration of the ink into the medium passes after the ink is deposited on the recording material.--

Please substitute the following paragraph for the paragraph starting at page 4, line 26 and ending at page 5, line 1.

--According to another aspect of the present invention, there is provided a recording method comprising the steps of:--

Please substitute the following paragraph for the paragraph starting at page 5, line 4 and ending at line 6.

--applying heat to the ink; and applying to the ink, a processing liquid having a Ka value not less than 1 ($ml.m^{-2}.msec^{-1/2}$).--

Please substitute the following paragraph for the paragraph starting at page 5, line 7 and ending at line 9.

--According to a further aspect of the present invention, there is provided a recording method comprising the steps of:--

Please substitute the following paragraph for the paragraph starting at page 5, line 10 and ending at line 12.

--ejecting to a recording material, ink having a Ka value not more than 1 ($ml.m^{-2}.msec^{-1/2}$) and having a penetration property which increases with heat; then--

Please substitute the following paragraph for the paragraph starting at page 5, line 13 and ending at line 15.

--applying heat to the ink; and applying to the ink, a processing liquid having a Ka value not less than 1 ($ml.m^{-2}.msec^{-1/2}$).--

Please substitute the following paragraph for the paragraph starting at page 5, line 16 and ending at line 18.

--According to a further aspect of the present invention, there is provided a recording method comprising the steps of:--

Please substitute the following paragraph for the paragraph starting at page 5, line 19 and ending at line 20.

--depositing ink containing a coloring material having a polarity onto a recording material; and then--

Please substitute the following paragraph for the paragraph starting at page 5, line 21 and ending at line 27.

--applying to the ink, a processing liquid having a polarity opposite from that of [said] the coloring material after the rapid swell start point ts after penetration of the ink into the recording material, so that the coloring material in the ink is insolubilized by the processing liquid at least inside the recording material.--

Please substitute the following paragraph for the paragraph starting at page 6, line 15 and ending at line 17.

--Figure 3 is an illustration of a recording process, and an ink and dot on and in the recording sheet in the first embodiment.--

Please substitute the following paragraph for the paragraph starting at page 6, line 18 and ending at line 20.

--Figure 4 is an illustration of a recording process, and an ink and dot on and in the recording sheet in the first embodiment.--

Please substitute the following paragraph for the paragraph starting at page 6, line 24 and ending at line 26.

--Figure 6 is a block diagram of a control circuit of a [serial type] serial-type recording device according to the second embodiment.--

Please substitute the following paragraph for the paragraph starting at page 6, line 27 and ending at page 7, line 3.

--Figure 7 is a schematic top plan view of a major part of an apparatus to illustrate a recording process in the recording device of a serial type according to second embodiment.--

Please substitute the following paragraph for the paragraph starting at page 7, line 25 and ending at line 27.

--Figure 15 is an illustration of [a] the difference in the penetration state of the ink into the recording paper, depending on the use or non-use of [the] a heater.--

Please substitute the following paragraph for the paragraph starting at page 8, line 4 and ending at line 6.

--Figure 17 is a characteristic graph showing [a] the relation between the elapsed time and the penetration amount of the ink.--

Please substitute the following paragraph for the paragraph starting at page 8, line 14 and ending at line 20.

--Figure 20 illustrates a mechanism wherein processing liquid is ejected to a deposited ink with the state wherein the ink is penetrated in the direction of the depth (thickness) to within a predetermined range in the recording material, so that coloring material of the ink reacts in the paper to [insolubilized] insolubilize the ink.--

Please substitute the following paragraph for the paragraph starting at page 8, line 21 and ending at line 22.

--Figure 21 illustrates [a] the penetration speed of ink.--

Please substitute the following paragraph for the paragraph starting at page 8, line 23 and ending at line 24.

--Figure 22 shows [a] the relation between acetylenol content in ink and tw, ts.--

Please substitute the following paragraph for the paragraph starting at page 9, line 2 and ending at line 10.

--In the present invention, [the] a processing liquid capable of reacting with and fixing a coloring material of ink is supplied to the ink [which] that has [been] penetrated [to] the fibers of the recording material and [which] that has started to swell ("swelled ink" which is the ink after the swell start time Ts has elapsed or the ink changed by a heater or the like). The property of the processing liquid or the heating after the processing liquid application or the like, is usable.--

Please substitute the following paragraph for the paragraph starting at page 9, line 12 and ending at line 14.

--(1) it is preferable to apply an ultra- penetrative($Ka \geq 5$) processing liquid to an ink having $Ka \leq 3$ m $m^{-2}.msec^{-1/2}$[.];--

Please substitute the following paragraph for the paragraph starting at page 9, line 15 and ending at line 20.

--(2) it is preferable that when ink has $Ka \leq 1$ and has a penetration property [which] that exhibits temperature dependence, heat is applied by a heater after ink application to the recording material, and then penetrative processing liquid, which is semi-penetrative or more penetrative, is applied[.]; and–

Please substitute the following paragraph for the paragraph starting at page 9, line 21 and ending at page 10, line 2.

--(3) it is preferable that when the ink is semi-penetrative or more penetrative (Ka>1), [the] heat is applied by a heater after ink application to the recording material, and thereafter, semi-penetrative or more penetrative processing liquid is applied. Further preferably, as a second step, heat is applied by a heater after the first step. The processing liquid in this case may by a semi-penetration property.--

Please substitute the following paragraph for the paragraph starting at page 10, line 3 and ending at line 5.

--This is effective to promote the penetration of the processing liquid by the heater and to improve the fixing property by [the] evaporation promotion.--

Please substitute the following paragraph for the paragraph starting at page 10, line 6 and ending at line 10.

--It may be an ultra-penetrative processing liquid, and in such a case, the fixing property is further improved by [the] evaporation promotion, and [the] coating reinforcement is accomplished. By the second step, further advantages are provided.--

Please substitute the following paragraph for the paragraph starting at page 10, line 11 and ending at line 17.

--The ink deposited on the recording material penetrates in the direction of the depth. When the penetration is within a predetermined range, the processing liquid is ejected to the ink to react with and [insolubilized] insolubilize the ink, thus providing an image having a high

wearing property and a high image quality. This will be described in conjunction with Figure 20.--

Please substitute the following paragraph for the paragraph starting at page 10, line 18 and ending at page 11, line 15.

--In Figure 20, (a), the ink droplet is travailing toward the paper. In Figure 20, (b), the ink droplet reaches the paper. At this time, the ink collapses into a column having a diameter which is [approx. 2times of] approximately two times the ink droplet diameter. Figure 20, (c) shows a state in which the ink is attracted in the fibers at the surface portion of the paper, and it swells. In Figure 20, (d), the ink penetrates into the paper, and the processing liquid S is [travailing] travelling toward the deposited ink. In Figure 20, (e), the processing liquid is deposited on the ink and on the surface of the paper at the portion where the ink has been penetrated, and the processing liquid reacts with the ink. Figure 20, (f) shows a state wherein the processing liquid catches up with the penetrated ink. As a result, the coloring material in the ink is insolubilized by the processing liquid inside the paper, so that ink now not easily penetrates in the direction of the depth of the paper. In Figure 20, (g), the coloring material in the ink is insolubilized by the processing liquid, and the penetration stops. In this manner, not so much ink remains on the surface of the paper, but a large amount of the coloring material in the ink is insolubilized and trapped within 20μm adjacent the surface of the paper.--

Please substitute the following paragraph for the paragraph starting at page 14, line 11 and ending at line 15.

--Figure 17 is a characteristic graph of the penetration amount of the ink vs. elapsed time, and [are] plots [of] experimental results when the recording paper has a weight of $64g/m^2$, a thickness of [approx.] approximately 80μm and a porosity [approx.] approximately 50%.--

Please substitute the following paragraph for the paragraph starting at page 14, line 22 and ending at page 15, line 2.

--As will be understood from these [Figures] figures, the penetration amount of the ink relative to the elapsed time increases (penetration property is higher) with an increase of the content of the acetylenol. From Figure 17, it is understood that wet time tw decreases with an increase of the content of the acetylenol, and in the time period not reaching tw, the penetration property is higher if the content is larger.--

Please substitute the following paragraph for the paragraph starting at page 15, line 3 and ending at line 11.

--In the case of the ink not containing acetylenol(0% of the content), the penetration property is low, and is a [topping type] topping-type ink which will be described hereinafter. When the content of the acetylenol is 1%, the ink penetrates the recording paper 103 quickly, and the ink is a high-penetration ink which will be described hereinafter. When the content of the acetylenol is 0.35%, the ink is a semi-penetrative ink.--

Please substitute the following paragraph for the paragraph starting at page 15, line 14 and ending at line 19.

--When a relatively low penetration property ink is used, during the time until tw at which the wettability of the surface of the sized paper is raised, the ink is attracted by the inks of the paper, and [the swell] swelling occurs, and then the penetration starts due to the capillary action between the fibers.--

Please substitute the following paragraph for the paragraph starting at page 15, line 20 and ending at line 24.

--In the case of so-called plain paper used with office equipment such as in a copying machine, the paper contains sizing material to prevent spread, and therefore, the penetration does not start quickly, which means there is a so-called wet time tw.--

Please substitute the following paragraph for the paragraph starting at page 15, line 25 and ending at page 16, line 5.

--Even after the start of the penetration, the wettability of the ink relative to the paper does not rise due to the sizing material, and when the used ink is a so-called [topping type] topping-type ink, it relatively slowly penetrates, and then the ink swells into the fibers per se from a certain point of time. The time is [approx. 400-500msec] approximately 400-500 msec in the case of [topping type] topping-type ink. The point of time is ts.--

Please substitute the following paragraph for the paragraph starting at page 16, line 6 and ending at line 19.

--When a surfactant, such as acetylenol, is contained in the ink, the wettability of the ink relative to the paper is increased, the time becomes shorter, and the swell(into the attraction

of the ink to the fibers) speed is increased. Then, the penetration speed is also high, and the ink quickly swells into the fibers of the paper. With the increase of the amount of the acetylenol, tw and ts become shorter, and it is substantially 0 when the content is 1%. Here, tw and ts becomes closer with an increase [of] in the amount of the acetylenol, in the range of the 0.2-0.3% or higher content of the acetylenol. Figure 22 shows such a relation as the amount of the acetylenol vs. tw and ts.--

Please substitute the following paragraph for the paragraph starting at page 16, line 26 and ending at page 17, line 5.

--When the processing liquid is overlaid on the ink ts after the shot of the ink droplet on the paper, the reaction therebetween occurs at the position of contact, while quite a larger part of the ink including the edge portion penetrates inside the paper, but a part may remain on the surface; and the reaction advances gradually into the ink inside the paper.--

Please substitute the following paragraph for the paragraph starting at page 17, line 10 and ending at line 15.

--Since the penetration speed thereof is higher than that of the ink, and the processing liquid penetrates the ink with reaction therewith, so that the penetration of the ink is stopped at a position shallower adjacent the surface of the paper than when the processing liquid is not deposited.--

Please substitute the following paragraph for the paragraph starting at page 17, line 16 and ending at line 24.

--By doing so, much of the coloring material can be retained at a part close the surface of the paper, and thus the density is high. Even if a part of the ink remains on the surface of the paper immediately before the processing liquid is deposited on the ink, the ink does not [remains] remain on the surface of the paper at the edge portion of the ink dot, and therefore, so-called feathering, which is a bleeding in the form of whiskers, does not occur.--

Please substitute the following paragraph for the paragraph starting at page 17, line 25 and ending at line 27.

--Even if a part of the ink remains on the surface, most of such ink penetrates, since the penetration property of the processing liquid is high.--

Please substitute the following paragraph for the paragraph starting at page 18, line 1 and ending at line 3.

--Therefore, the amount of the coloring material at the surface of the paper is very small, and the wearing property is good.--

Please substitute the following paragraph for the paragraph starting at page 18, line 4 and ending at line 9.

--If the content of the acetylenol is increased to more than 0.3% to raise the penetration property of the ink, [the] feathering occurs abruptly after ts, depending on the material of the weight, and therefore, the content (weight%) is preferably not more [than0.3%] than 0.3%.--

Please substitute the following paragraph for the paragraph starting at page 18, line 10 and ending at line 15.

--When it is more than 0.3%, the penetration speed is so high that coloring material is not easily retained adjacent the surface of the paper even if the penetration speed of the processing liquid is increased, and therefore, it is preferably not more [than0.3%] than 0.3%.--

Please substitute the following paragraph for the paragraph starting at page 18, line 16 and ending at line 18.

--Figure 16 shows a proportional coefficient Ka relative to the content of acetylenol in ink, which is empirically obtained.--

Please substitute the following paragraph for the paragraph starting at page 18, line 19 and ending at line 26.

--The value Ka is measured using a dynamic penetration property test apparatus S (available from Toyo Seiki Seisakusho, Japan) through the Bristow method. In the experiments, PB sheets available from Canon Kabushiki Kaisha, Japan were used as recording paper. The PB sheet is usable with a copying machine or LBP of electrophotographic type and also with a printer of [ink jet] ink-jet recording type.--

Please substitute the following paragraph for the paragraph starting at page 19, line 3 and ending at line 11.

--From Figure 16, it is understood that the Ka value(ordinate) increases with the increase of the acetylenol content(abscissa), and the proportional coefficient Ka is determined in terms of the content of the acetylenol. Therefore, the penetration speed of the ink is determined in effect by the content of the acetylenol. The lines parallel with the ordinate across the curves indicate the range of variation of the results of measurements.--

Please substitute the following paragraph for the paragraph starting at page 19, line 25 and ending at page 20, line 5.

--In this table, the Ka value, the acetylenol content(%) and the surface tension(dyne/cm) are given for [topping type] topping-type ink, semi-penetrative ink, and high-penetrative ink. The penetration property of each ink relative to the recording paper is higher if the Ka value is larger. In other words, it increases with a decrease [of] in the surface tension.--

Please substitute the following paragraph for the paragraph starting at page 20, line 5 and ending at line 12.

--The Ka values in Table 1 are determined by measurement using a [dynamic penetration property] dynamic-penetration-property test apparatus S, available from Toyo Seiki Seisakusho. Japan. In the measurements, the recording paper was the above-described PB sheet available from Canon Kabushiki Kaisha, Japan. [The similar] Similar results were obtained for PPC sheet available from Canon Kabushiki Kaisha, Japan.--

Please substitute the following paragraph for the paragraph starting at page 20, line 15 and ending at line 23.

--As a condition when a surfactant is added to liquid, [a] the critical micelle concentration (CMC) of a surfactant in the liquid is known. The critical micelle concentration is a concentration at which several tens of molecules rapidly form by association a micelle when the concentration of the surfactant in the liquid is increased. The acetylenol is one of surfactants, and therefore, it exhibits the critical micelle concentration for the respective liquids.--

Please substitute the following paragraph for the paragraph starting at page 20, line 24 and ending at page 21, line 3.

--Figure 19 is a characteristic graph showing a relation with the surface tension when content of the acetylenol in water is adjusted. When the cell is formed, the surface tension does not decrease, and therefore, it is understood from this [Figure] figure that the critical micelle concentration (CMC) of the acetylenol relative to the water is [approx.0.7%] approximately 0.7%.--

Please substitute the following paragraph for the paragraph starting at page 21, line 4 and ending at line 11.

--When the critical micelle concentration and Table 1 are compared, it is understood that semi-penetrative ink, which is used in the embodiment of the present invention, which will be described hereinafter, and which is defined in Table 1, contains the acetylenol at a ratio which is smaller than the critical micelle concentration (CMC) of the acetylenol relative to the water.--

Please substitute the following paragraph for the paragraph starting at page 21, line 12 and ending at line 14.

--[The] A description will be [made] provided as to the case of the processing liquid being ejected after the recording of the ink.--

Please substitute the following paragraph for the paragraph starting at page 22, line 4 and ending at line 13.

--The relation between the ejection time difference and the wear resistance is such that wear resistance improves with [the] an increase of the ejection time difference. Particularly, when the black ink is a topping or non-penetrative ink, and the processing liquid is penetrative ink, the production of the feathering is very small when the ejection time difference from the ejection of the Bk ink to the ejection of the processing liquid is not less than [approx. 1sec] approximately 1 second.--

Please substitute the following paragraph for the paragraph starting at page 22, line 14 and ending at page 23, line 3.

--When the penetrative processing liquid is ejected while the ejected [topping type] topping-type Bk ink is not penetrated into the thickness of the recording paper, [the] a reacted liquid is normally produced by the mixture of the ink and the processing liquid, and [since] the penetration property of the reaction liquid is higher than the penetration property of the Bk ink, with the result of a higher probability of feathering. However, by making the ejection time difference long (such as [approx. 1sec] approximately 1 second or longer) between the ejection of the Bk ink and the ejection of the processing liquid, the processing liquid is ejected when the penetration of the Bk ink into the recording paper is substantially completed, and therefore, [the]

much less reacted liquid is [much less] produced. Thus, the coloring material is insolubilized by the processing liquid without feathering of the [topping type] topping-type Bk ink.--

Please substitute the following paragraph for the paragraph starting at page 23, line 11 and ending at line 15.

--The composition of the Bk ink is preferably such that approximately 5% to 20% [approx.] of the diethylene glycol (DEG), for example, is contained to the increase the penetration property by the rise of the temperature by the heater.--

Please substitute the following paragraph for the paragraph starting at page 23, line 16 and ending at page 24, line 1.

--When the use is made with the Bk ink having a high penetration property, the image quality can be improved by shortening [shorting] the ejection time difference between the ejection of the ink [to] and the ejection of the processing liquid. The reason is that production of the feathering can be suppressed by the ejection of the processing liquid [ejected] before the occurrence of the feathering of the Bk ink penetrating into the recording paper, and before the Bk ink reaches deep into the recording paper, the processing liquid reacts with the ink, by which the Bk ink is insolubilized in [the] a range close to the surface of the recording paper, and the OD value is high.--

Please substitute the following paragraph for the paragraph starting at page 24, line 8 and ending at line 13.

--By applying heat by a heater to the ejected Bk ink, the penetration of the Bk ink can be kept from reaching the deep position, and [the] feathering can be suppressed, and therefore, the time range can be expanded, and [the] satisfactory results can be obtained [for the various nature].--

Please substitute the following paragraph for the paragraph starting at page 24, line 15 and ending at line 25. A marked-up copy of this paragraph, showing the changes made thereto is attached.

--(Embodiments)

(first embodiment)

Figure 1 is a side view of a full-line type recording device according to a first embodiment of the present invention. The recording device 1 is of an [ink jet] ink-jet recording type wherein the ink is ejected from a plurality of ink jet recording heads of a full-line type arranged along a feeding direction of the recording paper(arrow A), and is controlled by a control circuit shown in Figure 2, which will be described hereinafter.--

Please substitute the following paragraph for the paragraph starting at page 24, line 26 and ending at page 25, line 7.

--Each of the recording heads 101Bk, 101S, 101C, 101M, 101Y in the recording head group 101g is capable of effecting recording over a predetermined region in the width direction of the recording paper, which is perpendicular to the vertical direction of the [Figure] figure and the A direction, preferably over the entire width of the recording paper. Each recording head is provided with nozzles arranged substantially in the same direction as the width direction.--

Please substitute the following paragraph for the paragraph starting at page 25, line 8 and ending at line 25.

--The recording paper 103 is fed in the direction A by the rotation of a pair of registration rollers 114 driven by a feeding motor, and is fed by a pair of guiding plates 115 so that it is fed to conveyer belt 111 with the leading edge thereof aligned with the ink ejection. The conveyer belt 111 is in the form of an endless belt, and is supported by two rollers 112, 113, and the vertical position thereof is limited by the platen 104 at the upper side. The recording paper 103 is fed by rotation of at least one of the rollers 112, 113. The roller is rotated by a driving source such as an unshown motor, in the direction for feeding the recording paper 103 in the direction indicated by the arrow A. The recording paper 103 is carried on the conveyer belt 111 and is subjected to [the] a recording operation by the group of the recording paper heads 101g and is then discharged onto the [stocker] stacker 116.--

Please substitute the following paragraph for the paragraph starting at page 25, line 26 and ending at page 26, line 7.

--In the recording head group 101g, the recording head 101Bk for the black ink, the processing liquid head 101S for ejecting the processing liquid, and the color ink recording head(cyan head 101C, magenta head 101M, yellow head 101Y), are arranged as shown in the [Figure] figure along the feeding direction A of the recording paper 103. By ejecting the inks and the processing liquid by the recording heads, multi-color recording is effected.--

Please substitute the following paragraph for the paragraph starting at page 27, line 8 and ending at line 23.

--The black ink head 101Bk and the processing liquid head 101S are disposed with a predetermined clearance Di therebetween, and the ejection time difference between the ejection of the black ink and the ejection of the processing liquid is determined in accordance with the predetermined interval and the feeding speed of the recording paper 103. When the clearance Di between the black ink head 101Bk and the processing liquid head 101S is determined in the apparatus design, the feeding speed of the recording paper 103 is controlled to provide [the] an ejection time difference of [approx. 1sec] approximately 1 second so as to provide dot processing liquids. When the feeding speed is determined, the clearance between the black ink head 101Bk and the processing liquid head 101S is determined in compliance with the feeding speed.--

Please substitute the following paragraph for the paragraph starting at page 27, line 27 and ending at page 28, line 10.

--In the system controller 201, there are provided a micro-processor, a storing medium (ROM) storing the program for controlling device and processes, and storing material (RAM) for the operation of the micro-processor. The system controller 201 controls the entirety of the apparatus. The motor 204 operates in accordance with received information, such as the speed or movement distance from the driver 202, and feeds the sheet-like recording material, such as a recording paper, in the direction of arrow A in Figure 1.--

Please substitute the following paragraph for the paragraph starting at page 28, line 23 and ending at page 29, line 8.

--Buffers 209S, 209P temporarily [stores] store the data to be printed, and the storing capacity is different if the nozzle number of the recording head is different. A print controller

210 functions to control the recording head in accordance with the instructions from the system controller 201, and controls the printing speed, the print data number or the like, and further it generates the data for ejecting the processing liquid. A driver 211 drives the recording head 212S for ejecting the processing liquid and the recording head 212P for ejecting the ink for the image recording, and is controlled by the signal from the print controller 210.--

Please substitute the following paragraph for the paragraph starting at page 29, line 9 and ending at line 17.

--First, the image data is supplied from the host computer 206 to the reception buffer 207, and is temporarily stored there. Then, the image data stored are [reader] read by the system controller 201 and are converted into the buffers 209S, 209P. The system controller 201 controls the electric energization to the heater 102. [Malfunction] A malfunction, such as a sheet jam, an ink shortage, a sheet shortage or the like, can be detected by detection signals from an abnormality sensor 222.--

Please substitute the following paragraph for the paragraph starting at page 29, line 25 and ending at page 30, line 5.

--Referring to Figures 3 and 4, [the] a description will be [made] provided as to the recording process in this embodiment and the state of the ink and the dot on and in the recording paper 103. In this embodiment, the black ink has a topping property in Table 1. The processing liquid has a certain degree of a penetration property, and the acetylenol content is [approx.0.4-1.0%] approximately 0.4-1.0%.--

Please substitute the following paragraph for the paragraph starting at page 30, line 8 and ending at line 13.

--The black ink droplet 30a is deposited on the recording paper surface, and penetrates as indicated by a white arrow to the range indicated by the broken lines in the recording paper before the processing liquid droplet is ejected by the processing liquid head 101S (Figure 3, (b)).--

Please substitute the following paragraph for the paragraph starting at page 30, line 14 and ending at page 31, line 2.

--In this embodiment, the ejection time difference from the ejection of the black ink and the ejection of the processing liquid is [approx. 1sec] approximately 1 second. During this, most of the black ink droplet 30a ejected from the head 101Bk for the black ink penetrates into the recording paper 103. When the [approx. 1sec] approximately 1 second elapses from the black ink ejection while the recording paper 103 is being fed, a droplet 35 of the processing liquid(record improving liquid) having a certain degree of a penetration property is ejected onto the dot 30b provided by the ejection of the ink from the black ink head 101Bk (Figure 3, (c)). At this time, the rapid swell start point ts has been exceeded. The processing liquid and the dye in the black ink react to [insolubilized] insolubilize the dye in the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 31, line 3 and ending at line 13.

--The dot 30b provided by the black ink and the processing liquid droplet 35a ejected on the dot 30b are heated by the heater 102 (Figure 3, (d)), by which [the evaporations]

evaporation of the water content in the black ink and in the solvent of the processing liquid [are] is promoted, so that the reaction speed and the fixing property are enhanced (Figure 3, (e)). Here, if the content of the acetylenol in the processing liquid is not less [than0.7%] than 0.7%, the heating with the heater is not necessary, but the strength of the reaction liquid coating is improved by the heating.--

Please substitute the following paragraph for the paragraph starting at page 31, line 14 and ending at line 16.

--Even when the content of the acetylenol is not more [than0.7%] than 0.7%, the heat provides [the] effects substantially [similarly] similar to the ultra-penetrative.--

Please substitute the following paragraph for the paragraph starting at page 31, line 17 and ending at line 23.

--As described in the foregoing, the black ink droplet 30 is ejected, and the processing liquid droplet 35 is ejected to be overlaid thereon with a delay of not less than [said] ts to permit a certain degree of penetration of the black ink into the recording [paper(approx. 1sec)] paper (approximately 1 second), so that ink can be insolubilized inside the recording paper.--

Please substitute the following paragraph for the paragraph starting at page 32, line 17 and ending at page 33, line 3.

--Here, the ink ejected by the color ink head (101C, 101M, 101Y) is a high-penetrative ink described above, and therefore, the penetration speed into the recording paper 103 is high, and the spread does not easily occur even if the other color ink is deposited to the neighborhood

thereof. The black ink droplet 30 is a [topping type] topping-type ink, which has a [low] lower penetration property than the color ink. Therefore, when another color ink droplet is deposited to [the] a position adjacent thereto, [the spread] spreading easily occurs. However, since the processing liquid droplet 35b is overlaid on the dot 30b of black ink droplet 30, and the black ink is heated by the heater 102 if necessary, the ink is insolubilized in the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 33, line 4 and ending at line 13.

--Accordingly, as shown in Figure 4, (b), even if the color ink droplet 40a is ejected to [the] a position adjacent to the dot 30b provided by the black ink droplet 30, it does not produce [the] a spread with the color ink. Even if the dot 30b of the black ink droplet 30 and the dot 40b of the color ink droplet 40a are adjacent to each other, there occurs no spread at the boundary between the dots 30b and 40b, and therefore, the image has a sharp boundary portion between [the] different colors.--

Please substitute the following paragraph for the paragraph starting at page 33, line 14 and ending at line 16.

--By the application of the processing liquid before the color ink, [the] water[-] resistance can be provided for the color print.--

Please substitute the following paragraph for the paragraph starting at page 33, line 23 and ending at line 26.

--The penetration of the black ink into the recording paper 103 may be promoted by using black ink containing 0.3% of the acetylenol so that its penetration property is slightly higher than the [topping type] topping-type ink.--

Please substitute the following paragraph for the paragraph starting at page 33, line 27 and ending at page 34, line 13.

--By using such a heating step or by using black ink having a relatively high penetration, the ts can be effectively shortened [shorted], and therefore, good images can be formed even with the ejection time difference reduced to less than [1sec] 1 second, so that there is clearance between the black ink head 101Bk and the processing liquid head 101S[, thus permitting] to permit downsizing of the apparatus. When the clearance between the black ink head 101Bk and the processing liquid head 101S is determined in the design of the apparatus, the feeding speed of the recording paper 103 can be raised. The feeding speed is to be determined in consideration of the recording speed at which the recording head can properly eject the ink.--

Please substitute the following paragraph for the paragraph starting at page 34, line 25 and ending at page 35, line 11.

--The recording paper 103 (recording material) is supplied from the sheet feeder 105 and is discharged through the printing portion 126. In this embodiment, the inexpensive plain paper is used as the recording paper 103. The printing portion 126 is provided with a recording head 101 carried on a carriage 107, and the recording head 101 is reciprocable along the guiding rail 109 by a motor 604 shown in Figure 6. The recording head 101 has a black ejection portion 108Bk for ejecting black ink, a processing liquid ejecting portion 108S for ejecting processing

liquid, and a cyan ejection portion 108C, a magenta ejection portion 108M and a yellow ejection portion 108Y for ejecting the respective color inks.--

Please substitute the following paragraph for the paragraph starting at page 35, line 12 and ending at line 25.

--To each of the ejection portions, the ink is supplied from unshown ink container, and [the] a driving signal is supplied to the electrothermal transducer(heater) for ejecting the liquid provided in each of the nozzles. By this, a bubble is generated in the ink by thermal energy applied to the ink, and the ink is ejected by the pressure resulting from the bubble generation. In other words, a so-called [bubble jet] bubble-jet type is used for the ink ejection. Ejection outlets in the ejection portion are arranged in a perpendicular direction relative to the movement direction of the recording head 101, that is, in the same direction as the feeding direction X of the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 35, line 26 and ending at page 36, line 6.

--A heater 102 is provided so as to cover the entire area of the movement range of the carriage 107 at a position opposed to each of the ejection portions. In this embodiment, the heater 102 is in close contact to the recording paper 103 at the back side of the recording paper 103, and the heater 102 is a ceramic heater, which is suitable for the heating of the surface contacted thereto.--

Please substitute the following paragraph for the paragraph starting at page 36, line 7 and ending at line 10.

--The recording head 101 effects the recording at the resolution of 360dpi, and the driving frequency of the electrothermal transducer is 7.2kHz. The carriage 107 completes one reciprocation in [1.5sec] 1.5 seconds.--

Please substitute the following paragraph for the paragraph starting at page 36, line 11 and ending at line 25.

--Figure 6 is a block diagram of the control circuit for the recording device 5 of the serial type. The same reference numerals as in Figure 2 are assigned to the elements having the corresponding functions, and detailed descriptions thereof are omitted for simplicity. The motor 604 of Figure 6 receives information, such as a movement distance and speed, from the driver 602 and operates in accordance with the information to drive the recording head in the main-scanning direction(scanning direction). The motor 605 receives information, such as a movement distance and a speed, from the driver 602 and operates in accordance with the information to feed the sheet-like recording material, such as recording paper, in a sub-scan direction(feeding direction).--

Please substitute the following paragraph for the paragraph starting at page 37, line 3 and ending at line 18.

--In Figure 7, the carriage 107 reciprocates in the X direction, which is substantially perpendicular to the feeding direction Y above the recording paper 103 fed in the Y direction in close contact with the heater 102. The ejection outlets (indicated by dots in the Figure) of the

black ejection portion 108Bk, the processing liquid ejecting portion 108S, and the color ejecting portion (108C, 108M, 108Y) carried on the carriage 107, are opening in the direction of the ejection of the ink and the processing liquid against the recording paper 103. The heater 102 generates heat during the recording operation, and is provided at a position opposing to the region to which the liquid is ejected by the [processing liquid] processing-liquid ejecting portion 108S and the color ejecting portions 108C, 108M, 108Y.--

Please substitute the following paragraph for the paragraph starting at page 37, line 19 and ending at page 38, line 18.

--Each ejection portion has ejection outlets arranged to effect the recording in the width d along the feeding direction Y of the recording paper 103 by one scanning. In order to provide the time difference between the ejection of the ink by the black ejection portion 108Bk and the ejection of the processing liquid by the processing liquid ejecting portion 108S, the black ejection portion 108Bk and the processing liquid ejecting portion 108S are disposed with deviation by the recording width d in the feeding direction. The ejection time difference corresponds to the substantial completion of the penetration of the black ink to the predetermined range in the direction of the thickness of the recording paper. By such a constitution, the ejection of the ink by the black ejection portion 108Bk to the predetermined position of the recording paper 103 and the ejection of the processing liquid by the processing liquid ejecting portion 108S are effected with [the] a deviation corresponding to one scan of the carriage 107 (scanning period is [1.5sec] 1.5 seconds), thus providing the predetermined time difference. In this embodiment, therefore, the recording process [which] that is substantially similar to the recording process of

the recording device of the full-line type according to the first embodiment is accomplished in the recording device of a serial type.--

Please substitute the following paragraph for the paragraph starting at page 38, line 19 and ending at page 39, line 9.

--In such a recording process, the black ink is ejected by the black ejection portion 108Bk in the first scanning. The region in which the black ink is ejected, is upstream of the position of the heater 102, and is not heated by the heater 102. Then, the sheet is fed by the recording width d with a time delay to permit the penetration of the black ink into the recording paper 103, and the next scanning is effected to the same region on the heater 102, so that a processing liquid droplet is ejected to be overlaid on the dot formed by the black ink, by the processing liquid ejecting portion 108S. The heat generation of the heater 102 is effective to promote the [evaporations] evaporation of the water content contained in the black ink and in the solvent of the processing liquid, so that the fixing property is improved, and the coloring material in the ink is insolubilized in the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 39, line 10 and ending at line 12.

--By doing so, the wear resistance and overwriting resistance, as well as the water-resistance, are improved.--

Please substitute the following paragraph for the paragraph starting at page 39, line 13 and ending at line 18.

--Additionally, in this embodiment, the heater 102 is provided at the back side of the recording paper 103 in the region where the ejection portion (108C, 108M, 108Y) for ejecting the color ink eject the ink, so that the fixing property of the color ink can be improved.--

Please substitute the following paragraph for the paragraph starting at page 39, line 27 and ending at page 40, line 15.

--The recording device of Figure 8 is similar to the recording device 1 of Figure 1, but has [an] additional heaters 80a, 80b between the head 101Bk for the black ink and the head 101S for the processing liquid, and the black ink has a semi-penetrative property. The processing liquid has a penetration property higher than the black ink. By using them, the heating of the heaters 80a, 80b is effected after the black ink ejection, the penetration of the black ink is substantially confined in the region adjacent the surface of the recording paper 103, so that the record density is high. In addition, the processing liquid is ejected by the head 101S with this state, and therefore, the black ink can be insolubilized while the penetration of the black ink is confined adjacent the surface of the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 40, line 16 and ending at line 19.

--Referring to Figure 9, [the] a description will be [made] provided as to a recording process of the recording device shown in Figure 8, and the state of the ink and the dot on and in the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 40, line 20 and ending at line 24.

--The black ink droplet 30 is ejected by black ink head 101Bk (Figure 9, (a)). The black ink droplet 30a is deposited on the recording paper surface, and penetrates as indicated by a white arrow (Figure 9, (b)).--

Please substitute the following paragraph for the paragraph starting at page 40, line 25 and ending at page 41, line 11.

--During the period from the ejection of the black ink droplet 30 to the recording paper 103 being fed to the position of the head 101S, the dot 30b formed on the recording paper 103 is heated by the heaters 80a, 80b, and the evaporation of the water content is promoted during this period so that the fixing property is improved, and the penetration of the ink into the recording paper 103 is suppressed. Therefore, hardly any ink remains on the surface of the recording paper 103, and the processing liquid is ejected and overlaid thereon after the state of Figure 9, (c) is reached, wherein the ink is penetrated to a shallow position from the surface of the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 42, line 4 and ending at line 18.

--As described in the foregoing, according to this embodiment, by effecting the heating by the heaters 80a, 80b after the ejection of the semi-penetrative black ink, penetration of the black ink into the recording paper 103 can be suppressed, and with this state, the processing liquid is ejected, so that black ink is insolubilized inside the recording paper 103. By such

insolubilization, the wear resistance and the overwriting resistance, as well as the water-resistance, are improved. Since the penetration of the black ink to the deep position of the recording paper 103 can be suppressed, [so that] the density of the image of the black ink can be increased, and therefore, [the] sharp characters and line images can be provided.--

Please substitute the following paragraph for the paragraph starting at page 42, line 19 and ending at page 43, line 1.

--Since the processing liquid has a higher penetration property than the black ink, the processing liquid penetrates into the recording paper 103 at a speed higher than the penetration speed of the black ink and reacts with the black ink, so that penetration of the black ink into the recording paper 103 can be suppressed. By the solvent being separated by the insolubilization of the coloring material, [of] the black ink penetrates into the recording paper 103, so that the fixing property is improved.--

Please substitute the following paragraph for the paragraph starting at page 43, line 15 and ending at line 22.

--Referring to Figure 11, [the] a description will be [made] provided as to a recording process of the recording device of Figure 10 and the state of ink and dot on and in the recording paper 103. Except for the difference described above, the recording process shown in Figure 11, (a)-(d) is similar to that of Figure 9, (a)-(d), and therefore, the detailed description thereof is omitted.--

Please substitute the following paragraph for the paragraph starting at page 43, line 27 and ending at page 44, line 14.

--When the processing liquid is ejected, and the recording paper 103 is further fed, the heater 80c effects the heating (Figure 11, (e)). By this, the dot 30b provided by the black ink and the processing liquid droplet 35b ejected to be overlaid on the dot 30b are heated, so that [evaporations in] evaporation of the water content in the black ink and the solvent of the processing liquid are promoted (Figure 11, (f)). By the evaporation of the water content in the solvent, the possible flow of the insolubilized coloring material with the penetration of the solvent can be prevented, so that [sort of] feathering can be prevented, and therefore, the image quality of the characters and the line images of the black ink can be further improved.--

Please substitute the following paragraph for the paragraph starting at page 44, line 15 and ending at line 21.

--Even if a color dot(unshown) is printed adjacent to the dot 30b of the black ink in the structure of [said] the Figure 8 or 10, no spread at the boundary between the black and the color is produced since the coloring material of the black ink is insolubilized inside the recording paper 103, similarly to first embodiment.--

Please substitute the following paragraph for the paragraph starting at page 44, line 23 and ending at page 45, line 4.

--(Fourth embodiment)

The general arrangement of the recording device of this embodiment is the same as that of Figure 5, and Figure 12 schematically is a top plan view of the recording station (126).

The recording device is intended to accomplish [the] a recording process [which] that is the same as the recording process of the recording device of the full-line type according to the third embodiment, in a serial type.--

Please substitute the following paragraph for the paragraph starting at page 45, line 10 and ending at line 24.

--In the [serial type] serial-type recording device of Figure 12, the black ink is ejected by the black ejection portion 108Bk, and then it is heated by the heater 102 to a predetermined degree, and thereafter, the processing liquid and the color ink are sequentially ejected. At a position corresponding to the region scanned by the carriage 107 carrying each head, the heater 102 is disposed in close contact to the back side of the recording paper, so that regions for the ejections by the black ejection portion 108Bk and the processing liquid ejecting portion 108S are the same. The scanning by all heads is completed by the two scans with a time difference therebetween, so that coloring material in the black ink is prevented from insolubilizing at the surface of the recording paper.--

Please substitute the following paragraph for the paragraph starting at page 46, line 13 and ending at page 47, line 2.

--In this embodiment, the order of arrangement of the black ink ejecting portion 108Bk, the processing liquid ejecting portion 108S and the color ejection portions 108C, 108M, 108Y, is not limited by the feeding direction of the carriage 107 (direction X in the [Figure] figure). For example, as shown in Figure 13, which is a top plan view of the recording station (126), the color ejecting portions 108Y, 108M, 108C, the black ejection portion 108Bk and the

processing liquid ejecting portion 108S may be arranged in this order in the X direction from the left side in the [Figure] figure on the carriage 107, in which case, the black ejection portion 108Bk is operated by the first recording scan, and the processing liquid ejecting portion 108S and the color ejection portions are operated in the second recording scan to eject the processing liquid and the color ink.--

Please substitute the following paragraph for the paragraph starting at page 47, line 9 and ending at line 16.

--In this embodiment, the black image is recorded by two scans (divided recording), and the black image formed by the first recording scan is supplemented by the second recording scan to complete the black image. The second scanning is carried out with the predetermined time difference as in the foregoing embodiment. As regards the other color images, they are formed through one scan.--

Please substitute the following paragraph for the paragraph starting at page 47, line 17 and ending at line 25.

--The same reference numerals as in Figure 7 are assigned to the elements having the corresponding functions, and detailed descriptions thereof are omitted for simplicity. However, in Figure 14, the black ejection portion 118Bk has ejection outlets capable of providing the recording width $2d_1$ which is twice the recording width d of the other ejection portions (processing liquid ejecting portion 108S and the color ejecting portions 108C, 108M, 108Y).--

Please substitute the following paragraph for the paragraph starting at page 47, line 26 and ending at page 48, line 12.

--In Figure 14, each ejection portion has an array of the ejection outlets in the feeding direction Y of the recording paper 103. In the processing liquid ejecting portion 108S and the color ejecting portions (108C, 108M, 108Y), the ejection outlets are arranged in the Y direction so as to cover the width d at a position corresponding to the position of the heater 102, but in the black ejection portion 118Bk, the ejection outlets are arranged over the width 2d. The region [which] that is recorded by the black ejection portion 118Bk in the first ejecting scan, is deviated by the recording width d relative to the region recorded by the other ejection portions toward upstream in the feeding direction.--

Please substitute the following paragraph for the paragraph starting at page 48, line 13 and ending at line 20.

--For each X direction scanning of the carriage 107, the recording paper 103 is fed by [the] a distance corresponding to the recording width d in the y direction, and the recording operation by one scan of the carriage 107 and the feeding operation of the recording paper 103 are repeated to effect [the] recording substantially on the entire area on the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 48, line 21 and ending at page 49, line 1.

--As described hereinbefore, the recording width 2d of the black ejection portion 118Bk is wider than the recording width d of the other ejection portion, and therefore, the black ejection portion 118Bk scans twice as much as the other recording region. The black ejection

portion 118Bk effects a skipped recording in each of the two scans so that the image recording is completed by two scans.--

Please substitute the following paragraph for the paragraph starting at page 49, line 2 and ending at line 19.

--For example, an upstream side (upper side in the [Figure] figure), with respect to the recording paper feeding direction Y, of the recording width 2d is scanned by the first scan of the black ejection portion 118Bk, and the downstream(lower side in the [Figure] figure) side thereof is scanned by the second scan. In the first scanning of the carriage 107, the ejection outlets at the upstream side of the black ejection portion 118Bk [is] are used, and the black image is recorded in the skipped manner without heating by the heater 2. The recording paper 103 is fed in the Y direction by [the] a pitch corresponding to the recording width d. In the second scanning of the carriage 107, the [downstream side] downstream-side ejection outlets of the black ejection portion 118Bk is used, to effect the recording for the part skipped in the first scan to supplement the skipped portion (divided ejection of the black ejection portion 118Bk).--

Please substitute the following paragraph for the paragraph starting at page 49, line 20 and ending at line 26.

--By doing so, the first and second scans of the black ejection portion 118Bk are complementary with each other to complete the black image, by which the amount of the black ink ejected by one scan can be reduced. The pattern of the skip may be a staggered pattern or an inverse staggered pattern (checker pattern).--

Please substitute the following paragraph for the paragraph starting at page 49, line 27 and ending at page 50, line 7.

--In this manner, the region [which] that has been recorded by the upstream ejection outlet of the black ejection portion 118Bk is subjected in the next scan to the recording by the downstream ejection outlets, the ejection of the processing liquid by the processing liquid ejecting portion 108S, the ejection of the color ink by the color ejecting portions 108C, 108M, 108Y, and the heating by the heater 102.--

Please substitute the following paragraph for the paragraph starting at page 50, line 8 and ending at page 51, line 10.

--Thus, according to this embodiment, the ejection amount of the black ink in one scan by the black ejection portion 118Bk is reduced, and the amount of the ink ejected to [a] the neighborhood of another ink is can be minimized, as compared with the single scan. Particularly, when the staggered and inverse staggered patterns are used for the skipping, the ejection to the neighborhood position in X and Y directions in the [Figure] figure, does not occur. As a result, the overflow of the ink or flow of the ink [which] that may occur when a great number of ink droplets are deposited at adjacent positions do not occur, so that the boundary of the black image can be made further sharp. The ejection time difference between the ejection of the black ink by the downstream(lower side in the [Figure] figure) ejection outlet of the black ejection portion 118Bk and the ejection of the processing liquid by the processing liquid ejecting portion 108s, is shorter than in the second embodiment. However, the black ink already ejected by the upstream(upper side in the [Figure] figure) ejection outlet has been penetrated into the recording paper 103 at the time of the next scan, and when the ink is deposited to a position adjacent the

position at which the black ink is penetrated, the penetration of the later deposited ink is promoted. Therefore, even if the processing liquid is ejected continuously, the ink has been penetrated into the recording paper 103, so that coloring material of the ink can be insolubilized at a shallow position in the recording paper 103.--

Please substitute the following paragraph for the paragraph starting at page 51, line 11 and ending at line 17.

--In the foregoing, the heater 102 has been described as being in operation normally, and it may be turned off when an abnormality sensor 222 detects an abnormality, such as a sheet jam or the like, and the electric energization may be stopped to stop the heat generation operation by using a system controller 201 (Figure 2, 6).--

Please substitute the following paragraph for the paragraph starting at page 51, line 18 and ending at line 25.

--The present invention is particularly suitably usable in an [ink jet] ink-jet recording head and recording apparatus wherein thermal energy by an electrothermal transducer, a laser beam, or the like is used to cause a change of state of the ink to eject or discharge the ink. This is because the high density of the picture elements and the high resolution of the recording are possible.--

Please substitute the following paragraph for the paragraph starting at page 51, line 26 and ending at page 52, line 27.

--The typical structure and the operational principle are preferably the ones disclosed in U.S. Patent Nos. 4,723,129 and 4,740,796. The principle and structure are applicable to a so-called on-demand type recording system and a [continuous type] continuous-type recording system. Particularly, however, it is suitable for the on-demand type because the principle is such that at least one driving signal is applied to an electrothermal transducer disposed on a liquid (ink) retaining sheet or liquid passage, the driving signal being enough to provide such a quick temperature rise beyond a departure from the nucleation boiling point, by which the thermal energy is provided by the electrothermal transducer to produce film boiling on the heating portion of the recording head, whereby a bubble can be formed in the liquid (ink) corresponding to each of the driving signals. By the production, development and contraction of the [the] bubble, the liquid (ink) is ejected through an ejection outlet to produce at least one droplet. The driving signal is preferably in the form of a pulse, because the development and contraction of the bubble can be effected instantaneously, and therefore, the liquid (ink) is ejected with a quick response. The driving signal in the form of the pulse is preferably such as disclosed in U.S. Patents Nos. 4,463,359 and 4,345,262. In addition, the temperature increasing rate of the heating surface is preferably such as disclosed in U.S. Patent No. 4,313,124.--

Please substitute the following paragraph for the paragraph starting at page 53, line 1 and ending at line 18.

--The structure of the recording head may be as shown in U.S. Patent Nos. 4,558,333 and 4,459,600 wherein the heating portion is disposed at a bent portion, as well as the structure of the combination of the ejection outlet, the liquid passage and the electrothermal transducer as disclosed in the above- mentioned patents. In addition, the present invention is applicable to the

structure disclosed in Japanese Laid-Open Patent Application No. 123670/1984 wherein a common slit is used as the ejection outlet for plural electrothermal transducers, and to the structure disclosed in Japanese Laid-Open Patent Application No. 138461/1984 wherein an opening for absorbing a pressure wave of the thermal energy is formed corresponding to the ejecting portion. This is because the present invention is effective to perform the recording operation with certainty and at high efficiency irrespective of the type of the recording head.--

Please substitute the following paragraph for the paragraph starting at page 53, line 25 and ending at page 54, line 5.

--In addition, the present invention is applicable to a serial type recording head wherein the recording head is fixed on the main assembly, to a replaceable chip type recording head, which is connected electrically with the main apparatus and can be supplied with the ink when it is mounted in the main assembly, or to a cartridge type recording head having an integral ink container.--

Please substitute the following paragraph for the paragraph starting at page 54, line 6 and ending at line 16.

--The provisions of the recovery means and/or the auxiliary means for the preliminary operation are preferable, because they can further stabilize the effects of the present invention. As for such means, there are capping means for the recording head, cleaning means therefor, pressing or sucking means, preliminary heating means, which may be the electrothermal transducer, and an additional heating element or a combination thereof. Also, means for

effecting preliminary ejection (not for the recording operation) can stabilize the recording operation.--

Please substitute the following paragraph for the paragraph starting at page 54, line 17 and ending at line 27.

--As regards the variation of the recording head mountable, it may be a single head corresponding to a single color ink, or may be plural heads corresponding to the plurality of ink materials having a different recording color or density. The present invention is effectively applicable to an apparatus having at least one of a monochromatic mode mainly with black, a multi-color mode with different color ink materials and/or a full-color mode using the mixture of the colors, which may be an integrally formed recording unit or a combination of plural recording heads.--

Please substitute the following paragraph for the paragraph starting at page 55, line 1 and ending at line 6.

--The ink jet recording apparatus may be used as an output terminal of an information processing apparatus, such as computer or the like, as a copying apparatus combined with an image reader or the like, or as a facsimile machine having information sending and receiving functions.--

Please substitute the following paragraph for the paragraph starting at page 55, line 7 and ending at line 20.

--(Others)

In the mixture of the processing liquid(liquid composition) and the ink in the present invention, the mixture occurs on the recording material on or in the recording material, a low [molecular weight] molecular-weight component of the cation materials or the cation oligomer in the processing liquid and the anionic chemical compound in the pigment ink or the water-soluble dye having the anionic base causes association, and instantaneously separation from the liquid phase occurs, in the first stage of the reaction. As a result, [in the as a result pigment ink,] dispersion failure occurs, by which coagulated material of the pigment is produced.--

Please substitute the following paragraph for the paragraph starting at page 55, line 21 and ending at page 56, line 17.

--As the second stage of the reaction, the association product of the dye and the [low molecular] low-molecular cationic material or the cation oligomer or the coagulated material of the pigment is attracted by the polymeric component contained in the processing liquid, and therefore, the size of the coagulated material of the dye or of the coagulated material of the pigment is increased, so that they [are] do not easily enter the gaps between the fibers; as a result, only the liquid portion resulting from the solid-liquid separation enters the recording paper, and the print quality and the fixing property are both accomplished. The coagulated material formed by the cation material and the anionic dye and the cation oligomer or the low molecular component of the cation substance, or the coagulated material of the pigment, thus produced, have high viscosity, and do not move with the liquid, and therefore, the inks of different colors at adjacent positions do not mix together, and [not] no bleeding occurs. The coagulated material is essentially non-water-soluble, and therefore, the water-resistance of the final image is high. The light resistance of the image formed by the shield effect of the polymer is improved.--

Please substitute the following paragraph for the paragraph starting at page 56, line 18 and ending at line 21.

--Insolubilization and coagulation [occurs] occur only in the first stage in one example, and they occur in both of the first and second stages in another example.--

Please substitute the following paragraph for the paragraph starting at page 56, line 22 and ending at page 57, line 4.

--In the present invention, it is not necessary to use a cation polymeric substance having a large molecular weight or polyatomic metallic salt as in the prior-art, or if it is to be used, it is only for assistance, and therefore, the amount thereof is minimum. As a result, the deterioration of the coloring property of the dye, which has been a problem when the water resistance is provided by the use of the cation polymeric substance or the polyatomic metallic salt, can be avoided.--

Please substitute the following paragraph for the paragraph starting at page 57, line 5 and ending at line 10.

--The recording material used with the present invention is not limited to a particular one, [the] and a conventional copy sheet, bond paper or [anther] another plain paper is usable. Coated paper for ink jet [print] printing, a transparent film for OHP, usual high class paper, or glossy paper are usable.--

Please substitute the following paragraph for the paragraph starting at page 57, line 11 and ending at line 19.

--The present [invention] method is usable in a system comprising a plurality of machines, or a single machine. The present [invention] method may be implemented by supplying a program to a system or an apparatus. In such a case, a storing medium storing a program(software) for implementing the method of the present invention [method] is read out by the system or the apparatus, and this [invention] method is actually implemented in the system or the apparatus.--

Please substitute the following paragraph for the paragraph starting at page 57, line 20 and ending at line 23.

--According to the present invention, [the] image quality, [the] water-resistance immediately after the printing, [the] wear resistance, and [the] overwriting resistance are improved.--